

dry, these cannot be lumped together for correlation purposes, as the whole effect will be masked. We are reminded of the sun-spot maximum of 1893, which was associated with great heat in England and France, but was exceptionally cold in America and other parts of the world. This limitation of districts may not, as the author recognises, be the same for short periods as for long ones, but he finds the major characteristics in mountain regions very much alike over distances of fifty or sixty miles, and relies upon the evidence of the trees themselves for the demarcation of the districts.

One other small difficulty Prof. Douglass has met in an ingenious manner. It is often noticed that such an element as rainfall, when expressed as departure from the mean, as it must be in correlation problems, is arithmetically lacking in symmetry, since the defect can only be 100 per cent. at most, while excess can be very much larger. Geometrically, this can be avoided by using a logarithmic scale, but this flattens the variation very much. Prof. Douglass's device is to leave the deficient amounts unaltered, but in the case of excessive falls to invert the fraction and measure upwards from the normal. Thus a rainfall of twice the normal is indicated by a point just so far above the normal line as the point indicating a rainfall of half the normal is below it. The symmetry is not perfect, as, of course, no possible wetness can give a point corresponding to zero rainfall, but the method is convenient in places where zero rainfall in the unit period is unknown.

W. W. B.

The Interferometer in Physical Measurements.¹

A FOURTH volume describing the researches of Prof. Carl Barus with interferometers has recently been issued. The classical work of Fizeau, who applied interference methods to the determination of expansion coefficients, directed attention many years ago to the possibility of the kind of work which has been so well developed by Michelson and others, and in the present series of papers Prof. Barus seeks to develop the methods of application of the interferometer to a somewhat wide range of physical measurements. These include spherometer measurements, elastic deformation of small bodies, elongations due to magnetisation, pressure variation of specific heat of liquids, and even electro-dynamometry. The remainder of the volume deals with various modifications of the interferometer methods and with certain gravitational experiments.

Doubtless such an investigation of methods will be useful to workers in any of the foregoing fields, but so far as a first impression is to be trusted it would appear that the main interest has lain in the *method* rather than in any results which have been attained.

In order to study the motion of a contact lever, it may be made to carry two small mirrors reflecting normally two beams which are afterwards caused to interfere. Any rotation of the lever obviously causes a difference of path, which appears in the shifting of the easily recognisable and distinctive central "achromatic" interferometer fringes, such motion being measured by a plate micrometer or "graticule" in the observing telescope.

The two mirrors form the limbs of a "T" piece, which is pivoted about a hinge at the end of the foot. One limb ends in a contact pin which abuts against the surface, the motion of which is to be measured.

In such circumstances Prof. Barus estimates the

limiting sensitiveness to be 33×10^{-6} cm., or perhaps even a third of this amount, but it should not be forgotten that the very simple interferometer system of an optical test-plate has a sensitiveness of about a quarter wave-length, say 12×10^{-6} cm., and this without a doubtful hinge and another contact. The contact lever can, of course, deal with non-specular surfaces, but to use it as a spherometer for a glass lens seems quite needless. Naturally, an apparatus of this nature is excellently adapted to such a problem as that of investigating the changes of length of a magnetised rod, and, although no very novel results are obtained, the investigation has been comparatively easy, and the method is well adapted for demonstration.

Suitable self-adjusting interferometers, such as are described in chap. vii., ought to find an increasingly useful place in the physical laboratory, and students should be taught the practical use of such instruments and their modifications. There is too great a tendency to treat an interferometer as a piece of apparatus sacred to one or two highly specialised purposes, but with little more than a few pieces of good plane parallel glass a set of instruments can be made up which should be of the greatest use in teaching and research.

One could wish, perhaps, that some one problem had been attacked and solved thoroughly. The curiously unfinished nature of the work is disappointing, but we must conclude that the method is the chief object. As regards the text, the descriptions are clear and praiseworthy, but the diagrams are both inadequate and unsatisfactory.

L. C. M.

Canvas-destroying Fungi.

WHEN men again began to take to their tents at the outbreak of war, many noticed that dark brown and black spots, frequently of a diamond shape, were not uncommon on the canvas. Small, surreptitiously acquired bits began to be scattered around for information as to the identity of the moulds causing the rot. Now it is very surprising that so little work has been done on canvas-destroying fungi. That canvas is liable to suffer from moulding seems generally to be known, judging from the fact that any material likely to get wetted is usually "cutched." Shortly before the war aircraft workers began to interest themselves in the fungi concerned in the damage, but it was not until war broke out that one realised the extent of the destruction of sails, tents, etc., by these organisms.

Major W. Broughton-Alcock, in the *Journal of the Royal Army Medical Corps* for December last, gives a short account of investigations carried out by him in Malta, Italy, and (in conjunction with Miss A. Lorrain Smith) at the Natural History Museum. In Malta attention was soon attracted to the rapid spotting and destruction of tentage—awnings last there only about a year. The investigators found that the principal agents of destruction of cotton- and flax-made canvas are *Macrosporium* and *Stemphylium*. The latter is the more prevalent in Malta, and could be isolated by exposing culture plates to the air. The colours of the spots on canvas correspond to the colours seen in cultures, being first brown and then black. The variation in the colour of the spots, especially noticed in flax-made and more resistant canvas, was found to be due to other fungi in association with the above genera—*Septoria*, *Alternaria*, *Helminthosporium*, *Chaetomium*, *Exosporium*, *Penicillium*, *Oospora*, *Torula*, *Saccharomyces*, and yellow pigment-forming and other air-borne bacteria. Though

¹ "Displacement Interferometry by the Aid of the Achromatic Fringes." Part iv. By Prof. Carl Barus. (Carnegie Institution of Washington, 1919.)

these fungi may assist in the destruction, no proof was obtained that this took place without the presence of *Macrosporium* and *Stemphylium*. The fungi grew well on Sabouraud's medium and on ordinary agar.

According to the author, the first signs of fungoid growth appear on the inner side of the roof portions of tents and marquees. Often within three months pressure on the spots made by the fungi leads to perforation, or a strong wind causes tearing.

Cotton and linen duck-canvases ready for tent-making were examined, but, though the flax fibres were in good condition, brown mycelium was found more or less in abundance. It is suggested that the fungi reach and begin growth during the retting of the flax, though they may be present on the growing plant. Mycelium was not found on new cotton-made canvas, and "this is not surprising when its method of preparation is studied." It is not, however, probable that the infection of linen canvas is restricted to the period of retting. Guéguen (*NATURE*, vol. xcix., 1917, p. 206) was of the opinion that fungi from the dead stems of the textile plant were introduced amongst the fibres. This might account for their absence from new cotton-made canvas, but there is little doubt that both linen and cotton canvases often become infected after having been made up.

Experiments showed that the Willesden (cuprammonium) method and cutch treatment prevented the growth of the fungi. A method suggested by Prof. Pinoy (soft soap 1 in 5000 solution, followed by a mixture of 1 per cent. of alum and CuSO_4) greatly inhibited the growth, and its extended employment in Malta gave very satisfactory results. Mango-treated canvas was in no way inhibitive.

No mention is made as to whether the "cutch" was the ordinary commercial cutch (product of *Acacia*, etc.) or whether it was sodium chromate, which was used in certain areas. In Salonika this was found the best preventive for "diamond spot" on comparison with Guéguen's and Pinoy's treatments, and was at the same time a satisfactory camouflage.

J. RAMSBOTTOM.

The Economic Pursuits of the Trobriand Islanders.

AT a meeting of the Royal Anthropological Institute held on Tuesday, June 1, Mr. S. H. Ray, vice-president, in the chair, Dr. B. Malinowski read a paper on "The Economic Pursuits of the Trobriand Islanders." In his opening remarks Dr. Malinowski criticised the methods usually followed by observers in dealing with the economics of primitive peoples. Whereas it was usually held that such peoples were preoccupied solely with obtaining an adequate individual food supply, he had found that, at any rate among the peoples which had come under his observation, there was a highly complex economic organisation. In support of his view he described the economic system of the natives of Kiriwina or the Trobriand Islands, lying to the north of easternmost New Guinea. These natives are very efficient and industrious tillers of the soil. Agricultural production is highly organised, being based upon two social forces: the power of the chief and the influence of magic. The chief is overlord of the garden-land, and initiates in each season the allotment of garden-plots to individuals and settles any disputes about garden-land; he finances any communal work to which the natives resort when clearing the bush, planting the yams, and bringing to the gardens the big, heavy poles used in connection with magical rites. On the other hand, the traditional garden magician controls the detailed proceedings of the work and performs magical rites at each stage.

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There are several customary forms of communal work. An interesting institution of ceremonial enterprise, called *Kayasa*, is applied to gardening, fishing, oversea expeditions, and industrial activities, as well as to tribal sports, games, and dancing. Such a period of communal work is announced by the chief, who gives a big feast, which is followed during the continuation of the work by periodical distributions of food. Fishing, the building of houses and canoes, and other economic activities are based upon organisations similar to that of gardening. All are dependent upon the social power of the chief and the influence of the respective magician.

The distribution of the products is as highly organised as the production. The producer receives a certain portion, but a considerable part is used for the financing of big tribal enterprises through the chief, and another part is transformed into permanent wealth. By various tributes, dues, and offerings the chief collects about 30-50 per cent. of the tribal wealth, and he is the only member of the community who is allowed on a large scale to transform it into permanent wealth. This he does by keeping a number of industrial workers dependent on himself, who, for payment in food, produce polished "ceremonial" axe-blades, neck-strings of red shell discs, and arm-shells made of the conus shell, which are of very high value in the eyes of the natives, form the foundation of certain kinds of native trade, and are an indispensable feature of the social organisation of the natives. Every important transaction, whether ceremony or magical rite, birth, death, or marriage, has to be accompanied by gift and counter-gift. These are arranged, as a rule, so that while one party gives a substantial present of food, the other offers one of the tokens of native wealth, such as a ceremonial axe-blade, an arm-shell, or a string of shell discs. The powers of the chief are largely exercised through economic means. In inter-tribal affairs the chief backs up with gifts his summons to arms of his vassals, and the conclusion of peace after hostilities; and the same method of remuneration was followed when, in his narrower jurisdiction, direct punishment was meted out by ordering a special henchman to kill the offender or by calling upon a sorcerer to cast an evil spell on the victim. In both cases payment for the service was made in native tokens of wealth. These tokens of wealth have sometimes been designated by the term "money," but rather they represent stored-up wealth. Although a basketful of yams, a set of four coconuts, or a bundle of taro is, to a great extent, the common measure of value, there is no article among these peoples which, properly speaking, fulfils the function of a medium of exchange.

Two of these tokens of wealth, the arm-shells and the necklaces of shell beads, are used for a remarkable form of trade, called by the natives *Kula*, which embraces a ring of islands and archipelagoes lying to the east and north-east of British New Guinea, in which these two articles circulate in opposite directions. They are constantly being exchanged, scarcely ever being put to any use, but returning after a few years to the same district whence they were originally sent out, and then being traded again. The exchange is of a highly formal and ceremonial character, based on mythological tradition, and carried on according to very complex and rigid rules. Extensive and daring oversea expeditions in big sea-going canoes are made year after year, mainly in order to carry on this exchange. It involves a singular form of ownership, by which a token of wealth never remains in the hands of one man for any length of time. Instead of owning one article permanently, he owns a great number of articles temporarily. As a result of this